



Fuel Cells

An option for providing power when it's needed

In today's energy conscious society there is a growing demand for energy sources to provide a constant source of reliable electric power, whether it is for use during power outages or to help reduce peak power demands for a facility or building.

Fuel cells are being installed in ever increasing numbers to help facilities and businesses meet their electric power needs. If owners, designers and code authorities don't have a good understanding of codes and standards that cover stationary fuel cells, it is difficult for them to design, install and approve a safe, code compliant fuel cell installation.

Basic operation

Fuel cells work like batteries, but don't run down or need recharging. They produce electricity as long as fuel is supplied. A fuel cell consists of a negative electrode (or anode) and a positive electrode (or cathode), separated by an electrolyte. A fuel, such as hydrogen, is fed to the anode, and air is fed to the cathode. Hydrogen atoms are activated by the catalyst and separate into protons and electrons, which take different paths to the cathode. The electrons go through an external circuit, creating a flow of electricity. The protons migrate through the electrolyte to the cathode, where they reunite with oxygen and the electrons to produce water and heat, the clean byproduct of fuel cell power generation. Some fuel cells use natural gas as a fuel, rather than hydrogen, and convert it into hydrogen via a reforming process.

Listings

UL investigates and lists (certifies) stationary fuel cell power systems under the IRGZ product category. Information on the listings can be found in the Online Certifications directory ul.com/database using a "fuel cell" keyword search. UL currently has products listed for two companies

under this product category. These companies have several models listed for nonresidential, outdoor use. Some of the units are intended to be used with a natural gas fuel source, and others are intended for use with a hydrogen fuel source. The listings assume the products will be provided with fuel in accordance with the locally adopted fuel gas codes, such as the NFPA 2 Hydrogen Technologies Code, the NFPA 54 National Fuel Gas Code, or the International Fuel Gas Code.



Photo: Alan Russo

Product safety standard

Requirements used to investigate and list stationary fuel cell power systems are included in the Standard for Stationary Fuel Cell Power Systems, CSA America FC 1. This standard includes a comprehensive set of construction and performance requirements, and routine tests for these systems. UL uses this standard as a basis for listing stationary fuel cell systems.

Installation standard

The Standard for the Installation of Stationary Fuel Cell Power Systems, NFPA 853, provides requirements for the design, construction, and installation of stationary fuel cell power systems, and is not applicable for portable fuel cell power units. It provides fire prevention and fire protection requirements for safeguarding life and property and is applicable to all size stationary fuel cells power systems.



Fuel cell types

NFPA 853 recognizes three different types of fuel cell systems, as described below.

1. Prepackaged fuel cell power systems

These self-contained fuel cell power systems are designed as a single unit, are assembled in a factory, and shipped to the installation site. NFPA 853 requires these units to be designed, tested, and listed in accordance with the CSA FC 1, American National Standard for Fuel Cell Power Systems. Those prepackaged systems that are outside of the scope of CSA FC 1 must comply with the requirements for pre-engineered fuel cell systems. Prepackaged systems are labeled with Stationary Fuel Cell Power System UL Listing or UL Certified Marks.

2. Pre-engineered fuel cell power systems

Pre-engineered and matched modular component fuel cell power system are systems that have components that are assembled in a factory in separate modules, such as the fuel cell stack, reformer, and inverter and shipped to the installation site and assembled. NFPA 853 requires these systems and matched modular components to be designed and tested to meet the intent of CSA FC 1. Proprietary equipment or materials for which no generally recognized codes or standards exist are to be evaluated based on data from operational experience in the same or comparable service or test records covering the performance of the equipment or materials. Modules and accessories that have been investigated for use in pre-engineered systems are labeled with Stationary Fuel Cell Power System Accessory UL Listing or UL Certified Marks, or equivalent wording.

3. Engineered and field-constructed fuel cell power systems

Engineered and field-constructed fuel cell power systems include assemblies that are not preassembled or do not have factory-matched components. These systems are required to comply with all applicable requirements in NFPA 853, and be accompanied by a fire risk evaluation prepared by a registered engineer or third party acceptable to the code authority. These typically include larger and more complex systems.

Fire code proposals

As an increasing number of stationary fuel cell systems are being installed, fire code authorities are being challenged to ensure the systems are installed in a safe, code compliant fashion. Work is currently underway to update the International Fire Code and the NFPA 1 Fire Code to include more requirements to ensure installations meet nationally recognized safety standards. Updated requirements are anticipated to be included in the 2018 editions of these codes.